REMARKS

Prior to entry of the instant amendment, claims 17-30 are pending in the subject application, of which claims 17 and 24 are independent. By the instant amendment, claims 17 and 24 have been amended to positively recite the components of the inventive fuel cell. Claims 31-35 are added by the instant amendment. Claim 31 finds support in claims 17 and 19. Claim 32 finds support in claim 19. Claims 33-35 correspond to claims 18, 20 and 21. Now new matter is added.

Applicant notes with appreciation that the Examiner has acknowledged foreign priority in the Office Action mailed December 12, 2005.

Applicant further notes with appreciation the Examiner's consideration of the applicant's Information Disclosure Statement filed October 15, 2003

The Examiner is respectfully requested to indicate whether the drawing figures are acceptable in the next official action.

Claims 17-35 are presented to the Examiner for further or initial examination on the merits.

A. Introduction

In the Outstanding Office Action, the Examiner has rejected claims 17, 18 and 23 under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 5,234,777 to Wilson (hereinafter referred to as "the Wilson reference"); and rejected claims 17-30 under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 6,153,327 to Dearnaley et al. (hereinafter referred to as "the Dearnaley reference").

B. Asserted Rejection Over the Wilson Reference

Claims 17, 18 and 23 are rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being unpatentable over the Wilson reference. Applicant respectfully traverses this rejection.

B1. The Present Invention and its Advantages

The present invention pertains to a fuel cell that uses sputtering to form a nanophase catalytic layer. Of the many embodiments of the invention, claim 17 typically combines the elements of a proton exchange polymer membrane, catalytic metal particles coated on the proton exchange polymer membrane, carbon particles coated on the proton exchange polymer membrane, the catalytic metal particles and the carbon particles forming a nanophase catalyst layer, and electrodes bonded to the proton exchange polymer membrane.

B2. Distinctions of the Invention Over the Wilson Reference

The Wilson reference pertains to a membrane catalyst layer for fuel cells. The Wilson reference has been discussed in the Description of the Related Art section of the specification. This discussion at pages 3-4 of the specification states,

> However, this method is disadvantageous in that the entire volume of carbon particles cannot be fully utilized because carbon particles are tens to hundreds times larger than catalytic metal particles. Furthermore, another drawback lies in that a contact area between the proton exchange membrane and the catalytic layers, where catalytic reactions take place, is very small. Because the reactions, such as diffusion of reaction gases, or collection of current, take place in the catalyst-and-carbon particles contact surface, such a catalyst structure in which a relatively large carbon particle is loaded with a large number of catalytic particles is considered as being inefficient. (*Emphasis added*).

This describes a disadvantage of the approach taught by the Wilson reference, namely, that the catalyst-and-carbon particles contact surface that lies at an interface, or contact area, *between* a proton exchange membrane *and* a catalytic layer, is very small. Thus, it is apparent that applicant's description of the Wilson reference points out a significant structural distinction between the claimed membrane-electrode assembly and the structure described in the Wilson reference, namely, that the Wilson reference's formation of a *separate* catalyst layer results in inefficiencies due to a limited reaction area.[1]

Further, the Wilson reference at column 4, line 50 to column 5, line 14 (Protocol I) discusses forming catalyst layers by repeatedly coating a backing with catalyst-containing ink, then drying. Protocol II at column 6, lines 11-49 of the Wilson reference similarly applies multiple coats of catalyst-containing ink to a membrane.

The Wilson reference fails to disclose or suggest a catalyst formed of nanoparticles obtained by sputtering. The Wilson reference additionally fails to disclose or suggest a 2-10 nm particle size, such as is set forth in claims 19 and 26 of the present invention.

In contrast, independent claims 17 and 24 of the present invention recite a "nanophase catalyst layer." In comparison, the Wilson reference may discuss supported catalyst 24 and carbon particles 25 contained in a film 22 less than 10 μm thick (see the Wilson reference at column 4, lines 22-32), but Wilson has no teaching or suggestion of the magnitude of these particles. As a result, Wilson clearly fails to disclose or suggest a "nanophase catalyst layer."

---

[1] See also the Abstract of the Wilson reference, which states, "A gas reaction fuel cell incorporates a thin catalyst layer between a solid polymer electrolyte (SPE) membrane and a porous electrode backing. . . . The cured film is then transferred to the SPE membrane . . . to form a catalyst layer."

Fig. 1A

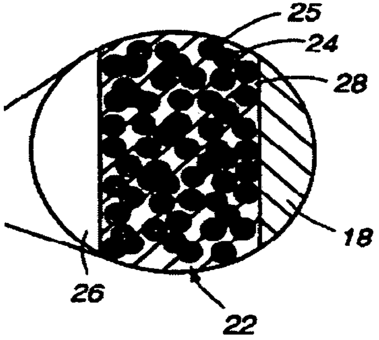
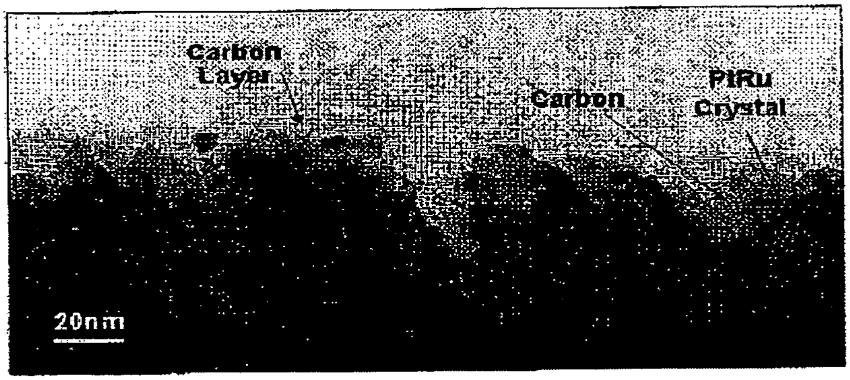


Figure 1A of the Wilson Reference

Nonetheless, at page 5, lines 2-4 of the Office action, the Examiner asserts, "It is asserted that the structure in the Wilson reference is indeed the same as that claimed as the carbon and catalyst particles are nano-sized having dimensions of 2-5 nm and 100 nm, respectively." However, the film 22 of the Wilson reference has a magnitude of "less than 10 μm." (Column 4, line 26). This particle size shown and depicted in the Wilson reference appears much larger than the nano-features shown, for example, in Figure 2F of the present invention, which is reproduced below.

FIG. 2F



As a result, the Wilson reference clearly fails to anticipate the present invention set forth in independent claims 17 or 24. Claims depending upon claims 17 or 24 are patentable for at least the above reasons.

Alternately, the Examiner has asserted that the present invention is obvious over the single Wilson reference. To establish a *prima facie* case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." *MPEP §2143.* In addition, if a reference needs to be modified to achieve the claimed invention "there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion." *Sibia Neurosciences Inc. v. Cadus Pharmaceutical Corp.*, 225 F.3d 1349, 55 USPQ2d 1927 (Fed. Cir. 2000).

In this case, the Examiner has failed to point out exactly where in the single Wilson reference resides an explicit teaching or suggestion of such features typified by a "nanophase catalyst layer," such as are set forth in independent claims 17 and 24 of the present invention. As a result, a person having ordinary skill in the art would not be motivated by the Wilson reference to produce claims 17 or 24 of the present invention. A *prima facie* case of obviousness has thus not been made. Claims depending upon claims 17 or 24 are patentable for at least the above reasons.

Further, even if one assumes *arguendo* that some unpatentability may be alleged, the present invention shows unexpected results over the related art catalyst technologies typified by the Wilson reference. As evidence of unexpected results, the Examiner is respectfully requested to note the unexpected results discussed at pages 17 and 18 of the specification, which include electron microscope observations and cell potential versus current density graphs set forth in the drawing figures. The advantages of the present invention are thus clear.

This rejection is overcome and withdrawal thereof is respectfully requested.

C. Asserted Rejection Over the Dearnaley Reference

Claims 17-30 are rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being unpatentable over the Dearnaley reference. Applicant respectfully traverses this rejection.

The present invention and its advantages have been discussed above.

The Dearnaley reference pertains to amorphous carbon containing a catalyst. The Dearnaley reference at column 4, lines 4-7 discusses, "The coating of the invention may comprise primarily amorphous carbon with the catalyst dispersed therein, or the coating may comprise primarily the catalyst with amorphous carbon dispersed therein." The Dearnaley reference fails to disclose or suggest "catalytic metal particles" and "carbon particles," such as are set forth in independent claims 17 and 24 of the present invention.

At page 5, lines 8-10 of the Office action, the Examiner points to column 4, lines 4-15 of the Dearnaley reference. However, the Dearnaley reference at column 4, lines 11-12 clearly states that "the catalyst is uniformly dispersed in an amorphous carbon coating." In contrast, claims 17 and 24 of the present invention recites "carbon particles" in the context of "the catalytic metal particles and the carbon particles forming a nanophase catalyst layer." These structural features of the fuel cell of the present invention are clearly different from structure disclosed in Dearnaley, which can be considered to be a solid dispersion of catalyst particle islands in an amorphous carbon sea (or *vice versa*).

At page 5, lines 12-13 of the Office action, the Examiner turns to the 100 angstrom layer thickness discussed at column 6, line 27 of the Dearnaley reference. The Examiner then analogizes this thickness to the particle size range set forth in claims 19 and 26 of the present invention. However, this layer thickness of the Dearnaley reference utterly fails to disclose or suggest a carbon particle size, especially since the carbon of the Dearnaley reference is present as an amorphous coating, not as particles. The Examiner is thus impermissibly changing the principle of operation of Dearnaley to infer anticipation and/or obviousness. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

As a result, the Dearnaley reference clearly fails to anticipate the present invention set forth in independent claims 17 or 24. Claims depending upon claims 17 or 24 are patentable for at least the above reasons.

Alternately, the Examiner asserts that the present invention is obvious over the single Dearnaley reference. However, as discussed above, the Examiner must point out where explicitly, in a single reference, a teaching or suggestion resides to modify the reference. As a result, one of ordinary skill in the art would not be motivated by the Dearnaley reference to produce claims 17 and 24 of the present invention. A *prima facie* case of obviousness has thus not been made. Claims depending upon claims 17 or 24 are patentable for at least the above reasons.

This rejection is overcome and withdrawal thereof is respectfully requested.

D. Statement of Substance of Interview

The Examiner is thanked for graciously conducting a personal interview with the applicant's representative on February 22, 2007. During the interview, proposed amendments to the claims were discussed in light of the Wilson reference and the Dearnaley reference. The Examiner appeared to indicate that the proposed claim amendments would overcome the prior art of record. At the end of the interview, the Examiner prepared an Interview Summary. The Interview Summary has been reviewed, and it appears to accurately reflect the substance of the interview.

E. Conclusion

The Examiner's rejections have been overcome, obviated or rendered moot. It is believed that a full and complete response has been made to the Office action. No issues remain. The Examiner is accordingly respectfully requested to place the application in condition for allowance and to issue a Notice of Allowability.

If the Examiner believes that additional discussions or information might advance the prosecution of the instant application, the Examiner is invited to contact the undersigned at the telephone number listed below to expedite resolution of any outstanding issues.

In view of the foregoing amendments and remarks, reconsideration of this application is earnestly solicited, and an early and favorable further action upon all the claims is hereby requested.

Respectfully submitted,

LEE & MORSE, P.C.

Date: February 22, 2007

Eugene M. Lee, Reg. No. 32,039

LEE & MORSE, P.C.
3141 FAIRVIEW PARK DRIVE, SUITE 500
FALLS CHURCH, VA 22042
703.207.0008 TEL
703.207.0003 FAX

PETITION and DEPOSIT ACCOUNT CHARGE AUTHORIZATION

This document and any concurrently filed papers are believed to be timely. Should any extension of the term be required, applicant hereby petitions the Director for such extension and requests that any applicable petition fee be charged to Deposit Account No. 50-1645.

If fee payment is enclosed, this amount is believed to be correct. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-1645.

Any additional fee(s) necessary to effect the proper and timely filing of the accompanying-papers may also be charged to Deposit Account No. 50-1645.